THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

Faculty of Engineering & Technology

DEPARTMENT OF MECHANICAL & AUTOMOTIVE ENGINEERING

DIPLOMA IN AUTOMOTIVE ENGINEERING
DIPLOMA IN CHEMICAL ENGINEERING
DIPLOMA IN MECHANICAL ENGINEERING (PLANT)

APS 2101: PHYSICS I

SUPPLEMENTARY EXAMINATIONS

SERIES: APRIL 2011

TIME: 2 HOUR

INSTRUCTION TO CANDIDATES

You should have an answer booklet, a calculator and drawing instruments.

This paper consists of **FIVE** questions in two sections A and B. Question ONE is compulsory, answer any two questions from section B.

SECTION A

QUESTION ONE

(a) State:
   I. Boyle's law
   II. Charles ' law
   2mks

(b) A mass of gas occupies a volume of 0.02m3 when its pressure is 150kN/m2 and its temperature is 17^0C. If the gas is compressed until its temperature is 57^0C, determine the :
   i. The new volume
   ii. Mass if the characteristic gas constant is 205J/Kg/K.
   5mks

(c) Calculate the quantity of heat required to convert 2kg of ice at -15^0C to steam at 100^0C given:
Specific latent heat of fusion of ice = 335kJ/Kg;
Specific latent heat of vaporization of water =2.26MJ/Kg;
Specific heat capacity of ice =2.1 kJ/KgK;
Specific heat capacity of water =4.2 kJ/kgK
8mks

(d) i) Explain FOUR advantages of mercury as a thermometric liquid.

ii) State TWO good reasons why water is considered unsuitable for use in thermometers .

iii) Draw and label a diagram of a clinical thermometer
10mks

(e) The temperature of 500g of a certain metal is raised to 100^0C and it is then placed in 200g of water at 15^0C. if the final steady temperature rises to 21^0C. Calculate the heat capacity of the metal.
5mks

SECTION B

QUESTION TWO

a) Differentiate the following terms

i) Heat capacity and specific heat capacity

ii) Latent heat of fusion and latent heat of vaporization. State the units in each case

4mks

b) Describe how specific heat capacity of water can be obtained by continuous flow method
9mks

c) A piece of copper of mass 100g is heated to 100^0C. It is then transferred to a well lagged copper can of mass 50g containing 200g of water at 10^0C. Calculate the final steady temperature of water after it has been well stirred. Neglect any heat losses and take the specific heat capacities of copper and water as 400Jkg^{-1}C^{-1} and 4200Jkg^{-1}C^{-1} respectively.

7mks

QUESTION THREE

a) State Charles law and show how it can be combined with Boyle's law to give the equation of state.
7mks

b) 125cm^3 of gas are collected at 15^0C and 755mm of mercury pressure. Calculate the volume of the gas at s.t.p.
6mks

c) An empty tube, 1m long is lowered vertically mouth downwards into a tank of water. What will be the depth of the top of the tube when the water has risen 20cm in the side of the tube? (Atmospheric pressure maybe assumed equal to 10.4 head of water.) 7mks

QUESTION FOUR

a) i).Define coefficient of thermal conductivity.
2mks

ii). Show that the thermal conductivity of a metal K is given by

$$\frac{Q}{At} = \frac{K(Q^2 - Q^1)}{l}$$

b) Calculate the quantity of heat conducted through 3m2 of a brick wall 10cm thick in one hour if the temperature of one side is 80C and on the other side is 280C.

QUESTION FIVE

a) Define the following terms

i) Latent heat of vaporization

ii) Specific latent heat vaporization
2mks

b) Explain why pieces of ice at 0^0C added to a drink at room temperature is more effective In cooling the drink than an equal mass of water at 0^0C 2mks

c) In an experiment to determine the specific heat capacity of water, a stream of water flows at a steady rate of $5.0gs^{-1}$ over an electrical heater dissipating 135W and a temperature rise of 5K is observed. On increasing the rate of flow to $10.0gs^{-1}$, the same temperature rise is produced with a dissipation of 240W. Explain why the power in the second case is not twice that needed in the first case and deduce a value for the specific heat capacity of water.
8mks

d) Dry steam is passed into a well lagged copper can of mass 250g containing 400g of water and 50g of ice at 00C. The mixture is well stirred and the steam supply cut off when the temperature of the can and its constituents reads 200C. Neglecting heat losses, find the mass of steam condensed. (specific heat capacities; water 4200J/KgK, copper,400 J/KgK; ice 336J/KgK. Specific latent heat of steam, 2260J/Kg; ice 336 J/Kg)

8mks